Package 'smds'

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Type Package

Title Symbolic Multidimensional Scaling

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Author Yoshikazu Terada, Patrick J. F. Groenen

Maintainer Yoshikazu Terada <terada@nict.go.jp>

Depends R (>= 1.8.0), MASS

Description Symbolic multidimensional scaling for interval-valued dissimilarities. The hypersphere model and the hyperbox model are available.

License GPL (>= 2)

NeedsCompilation yes

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R topics documented:

smds-package *Symbolic MDS*

Description

This package provides the following approaches of symbolic multidimensional scaling. For interval-valued dissimilarities, there are two models: the hypersphere model and the hyperbox model. We can optimize the stress function of each model by the BFGS method or the majorization minimization algorithm.

Details

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Version:	1.0
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The function for MDS of interval-valued dissimilarities is `IMDS()`.

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Author(s)

Yoshikazu Terada and Patrick J. F. Groenen

Maintainer: Yoshikazu Terada <terada@nict.go.jp>

idistBox *Compute the interval distance of the hyperbox model.*

Description

Compute the interval distance for given hyperbox objects.

Usage

```
idistBox(X,R)
```

Arguments

X	The center coordinate matrix
R	The radius matrix.

Value

idistBox returns the interval-valued dissimilarity matrix IDM (an object of class "array": IDM[1,,]: the lower dissmilarity matrix; IDM[2,,]: the upper dissmilarity matrix).

Author(s)

Yoshikazu Terada

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idistSph *Compute the interval distance of the hypersphere model.*

Description

Compute the interval distance for given hypersphere objects.

Usage

```
idistSph(X,r)
```

Arguments

X	The center coordinate matrix
r	The radius vector.

Value

idistSph returns the interval-valued dissimilarity matrix IDM (an object of class "array": IDM[1,,]: the lower dissmilarity matrix; IDM[2,,]: the upper dissmilarity matrix).

Author(s)

Yoshikazu Terada

IMDS *Multidimensional scaling of interval-valued dissimilarities.*

Description

Performs MDS for given interval-valued dissimilarities.

Usage

```
IMDS(IDM, p=2,eps= 1e-5 ,maxit =1000,model=c("sphere","box"),
opt.method=c("MM", "BFGS"), ini = "auto",report=100,grad.num=FALSE,
rel=0, dil=1)
```

Arguments

IDM	The interval-valued dissimilarity matrix (an object of class "array": IDM[1,,]: the lower dissmilarity matrix; IDM[2,,]: the upper dissmilarity matrix).
p	Number of dimensions.
eps	Convergence criterion for the majorization minimization algorithm.
maxit	Maximum number of iteretions.
model	If "sphere", then the hypersphere model is used. If "box", then the hyperbox model is used.
opt.method	If "BFGS", then the BFGS method is used for optimizing the stress function. If "MM", then the majorization minimization algortihm is used.
ini	List which consists of an initial center coordinate matrix ini[[1]] and an initial radius vector ini[[2]] (optional). If "auto", then a configuration of the classical MDS for (IDM[1,,]+IDM[2,,])/2 is used as the center coordinate matrix and radii are drawn from the uniform distribution $U(0,1)$.
report	The frequency of reports. Defaults to every 100 iterations.
grad.num	If FALSE, then exact gradient function is used in the BFGS method. If TRUE, then a numerical gradient is used in the BFGS method.
rel	If acc=1, accelerate by the relaxed update. If acc=0, the relaxed update is not used. Not used for the BFGS method. Defaults to 0.
dil	If acc=1, accelerate by the optimal dilation of the configration. If acc=0, the optimal dilation is not used. Not used for the BFGS method. Defaults to 1.

Details

The default optimization method is a majorization-minimization algorithm with the optimal dilation.

Method "MM" is a majorization-minimization (MM) algortihm for the specified model. If model="box", method "MM" is a MM algorithm, called I-Scal, which is proposed by Groenen et al. (2006). If model="sphere", method "MM" is a MM algorithm which can be considered as I-Scal for the hypersphere model.

Method "BFGS" is a quasi-Newton method (also known as a variable metric algorithm), specifically that published simultaneously in 1970 by Broyden, Fletcher, Goldfarb and Shanno. For more details, see Chapter 15 of Nash (1990).

Value

IMDS returns a list with components:

X	The best corrdinate matrix with p columns whose rows give the coordinates of the vertexes.

If model="sphere", r The best radius vector.

If model="box", R The best radius matrix with p columns whose rows give the radii of objects.

str	The value of the stress function of IMDS corresponding to X is returned.
str.vec	If "MM", then the vector of values on each iteration is returned.
EIDM	If "MM", then the interval-valued dissimilarity matrix correspondint to the estimated parameters.

Author(s)

Yoshikazu Terada

References

Groenen, P. J. F., Winsberg, S., Rodriguez, O., and Diday, E. (2006). I- scal: Multidimensional scaling of interval dissimilarities. *Computational Statistics & Data Analysis*, **51**, 360–378.

Nash, J. C. (1990) *Compact Numerical Methods for Computers. Linear Algebra and Function Minimisation.* Adam Hilger.

Examples

```
###################
#Fats and Oil data#
###################
################################
data(oil.idiss)
#Apply the hypersphere model via the BFGS method
set.seed(1)
res.bfgs <- IMDS(IDM=oil.idiss, p=2,model="sphere",opt.method="BFGS", ini = "auto")
plot(res.bfgs,main="Sph_bfgs")
#Apply the hypersphere model via the MM algorithm
set.seed(1)
res.mm <- IMDS(IDM=oil.idiss, p=2,model="sphere",opt.method="MM", ini = "auto")
plot(res.mm,main="Sph_MM")
#Apply the hyperbox model via the BFGS method
set.seed(1)
res.bfgs <- IMDS(IDM=oil.idiss, p=2,model="box",opt.method="BFGS", ini = "auto")
plot(res.bfgs,main="Box_bfgs")
#Apply the hyperbox model via the MM algorithm
```

```
set.seed(1)
res.mm <- IMDS(IDM=oil.idiss, p=2,model="box",opt.method="MM", ini = "auto")
plot(res.mm,main="Box_MM")
##############################
```

`oil.idiss` *Interval-valued dissimilarity data based on Ichino's fats and oil data*

Description

This dataset is interval-valued dissimilarity data of 8 different fats and oil.

Usage

```
data(oil.idiss)
```

Format

The interval-valued dissimilarity matrix (an object of class "array": `oil.idiss[1,,]`: the lower dissmilarity matrix; `oil.idiss[2,,]`: the upper dissmilarity matrix).

Examples

```
data(oil.idiss)
```

`plot.imds` *plotting the estimated spheres or boxes.*

Description

plotting the estimated hyperspheres or hyperboxes.

Usage

```
## S3 method for class 'imds'
plot(x, xylim="auto",clab=1:nrow(X),lab.cex=1,lab.col="black",...)
```

Arguments

`x`	Object class "imds"
`xylim`	The x limits (`xylim[1,1]`, `xylim[1,2]`) of the plot. The y limits (`xylim[2,1]`, `xylim[2,2]`) of the plot. Note that `xylim[i,1]` > `xylim[i,2]` (i=1, 2) is allowed and leads to a 'reversed axis'.
`clab`	A character vector for objects.
`lab.cex`	numeric character expansion factor.
`lab.col`	label color.
`...`	further graphical parameters (from par).

Author(s)

Yoshikazu Terada

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